ORIGIN OF THE DEPRESSION KNOWN AS MONTEZUMA'S WELL, ARIZONA.

THE singular bowl-shaped depression known as Montezuma's Well on Beaver Creek, Yavapai County, Arizona, is one of the noted natural wonders of that territory. It is frequently visited by tourists and others who get so far into the interior of Arizona as Camp Verde, from which the well is twelve miles distant. Hinton in his 'Handbook of Arizona' (1878) gives a fair representation, by a wood-cut, of one side of the well.

The depression is in the midst of a nearly level area; it is nearly circular, 500 to 600 feet in diameter, with vertical walls, or sides, from 30 to 40 feet downwards to the head of a talus slope extending to a circular pool of water, said to be of unfathomable depth.

The popular theory of the origin of this cavity and well in the plain is that it is volcanic; a crater, like a pit-crater. While there is a resemblance in form to a pit-crater there is no other point of resemblance. There are no volcanic rocks or traces of lava, except numerous broken metaltes left by the ancient cliff-dwellers who once dwelt in the cavernous spaces in the limestone walls around the pool. The water is not stagnant, it flows out by a subterranean channel to the adjoining valley of Beaver Creek, from which, probably, the supply is received at some more remote point above.

This depression is evidently the result of caving-in, a falling down, of the roof of a cavern formed by running water in the nearly horizontal limestone strata. Most of the débris of the former roof which was engulfed in the cavern has no doubt been largely dissolved and washed away by the flowing water.

The existence of once inhabited rooms, or chambers, around the well in the overhanging limestone cliffs, and also of extensive ruins of stone buildings above, around the borders of the depression, confirms the other evidences of the great antiquity of the well.

There are other peculiar basin-shaped depressions in the general surface in the vicinity of Flagstaff and Walnut Creek in Coconino County whose origin may be similarly explained or, perhaps, referred to the solvent action of surface waters sinking or percolating downwards through calcareous strata to some subterranean channel, or by subterranean streams.

The peculiar depressions in the soil of the lead and zinc region of Wisconsin, often seen at intervals along certain lines upon the surface, may be similarly accounted for. They indicate the downward flow of solvent waters to and along the 'crevices' in the horizontal limestones and thus are indicative of lodes or of ore to the miners.

The foregoing described phenomena suggest that the remarkable crater-like cavity known as 'Coon Butte Crater' may have similarly originated. This suggestion is made with some reluctance, inasmuch as I have not studied the locality. But it seems as if all the conditions so well and fully described by Mr. D. M. Barringer, and Mr. Tilghman, in their memoirs (*Proceedings of the Academy of Natural Sciences of Philadelphia,* December, 1905) may be explained upon the hypothesis of a sink or downward flow of surface (meteoric) water carrying away by solution the lime of the calcareous sandstone, reducing its volume, or forming cavernous spaces, which permitted the upper unsupported beds to fall in. Such solvent action would leave the silica of the calcareous sandstone in a divided pulverulent condition, much as it is found, with here and there portions with less lime or less decomposition. The subsidence of the area would carry down with it any meteoric fragments which were on the surface or in the soil, and to considerable depths.

The numerous masses of iron oxide or 'magnetite,' as described, are doubtless the residual fragments of siderolites originally highly charged with nodules of sulphides and phosphides, and probably with chlorine. The continuous oxidation and exfoliation of some meteorites, even when protected from the elements in museums, are familiar examples.

WM. P. BLAKE.

QUOTATIONS.

THE HUXLEY LECTURE.

PROFESSOR IVAN PETROVITCH PAWLOW, the celebrated professor of physiology at the Uni-

versity of St. Petersburg, delivered the Huxley lecture at Charing Cross Hospital on October 1. The function took place in the out-patient hall of the hospital, which was crowded with an enthusiastic audience. The professor was welcomed on his arrival in a small room adjoining the hall by an informal reception committee, consisting of Lord Kilmorey (chairman of the hospital), Sir A. Rücker, Professor Starling, Dr. Pavy, Professor Gotch, Dr. W. V. Bayliss, Dr. Mott, Mr. Waterhouse and Dr. Bosanquet. When Professor Pawlow was conducted into the hall by Lord Kilmorey, the reception accorded to the eminent physiologist was so hearty that it seemed to take him by surprise. In a few words Lord Kilmorey introduced the lecturer to the audience, and Professor Pawlow then proceeded to deliver his address. He spoke in German, and took for his subject the scientific investigation of the psychical faculties or processes in the higher animals. At the conclusion of the address Sir A. Rücker, principal of the University of London, moved a vote of thanks to Professor Pawlow. He assured him that the interest in his address was not confined to the walls of Charing Cross Hospital, but the University of London as a whole was delighted to welcome so distinguished a representative of Russian science. Professor Starling, in seconding the vote of thanks, said that the address bore out the old statement as to the close connection that existed between the advance of science and the advance of methods at the disposal of scientific investigators. Great strides had been made in the science of physiology by the introduction of anesthetics which had abolished pain from the physiological laboratory. The use of anesthetics necessitated the introduction of abnormal conditions into an experiment, but Professor Pawlow had now taught them how to experiment on the living animal in perfect physiological condition without pain, without anesthetics, and without even discomfort. Lord Kilmorey formally expressed the thanks of the meeting to Professor Pawlow, who replied in a few words suitably acknowledging the compliment.—*The British Medical Journal.*

ASTRONOMICAL NOTES.

THE POTSDAM PHOTOMETRIC DURCHMUSTERUNG.

VOLUME XVI. of the *Publikationen des Astrophysikalischen Observatoriums zu Potsdam* has just been issued. It contains the fourth and last zone of the photometric Durchmusterung, which has been carried on by Müller and Kempf during the last twenty years, of which the first volume appeared in 1894. It includes all stars in the northern heavens of the magnitude 7.5, and brighter, and forms a most important addition to the photometry of the stars.

Although the great discordance among the various estimates of brightness made some sort of exact measurements a necessary step in the advancement of astronomy, but little progress had been made until a quarter of a century ago. The first volume of the Harvard photometry, begun in 1879, was published in 1884, and the Uranometria Oxoniensis appeared in 1885.

The Durchmusterung of Müller and Kempf comes opportunely, since it gives measurements of great precision, and throws light on the results obtained by earlier observers. It is of the greatest importance, not only to reduce the accidental errors as much as possible, a result which has probably been accomplished by Müller and Kempf, but, especially, to show whether the systematic errors, which are inseparable from such investigations, are so small as to make the results trustworthy.

The work of Pritchard at Oxford was carried on with a wedge photometer; that of Pickering at Harvard with polarization photometers in which a polar star is compared directly with all the stars whose magnitudes are to be determined; the observations of Müller and Kempf have been made with photometers of the Zöllner type, in which, by means of an artificial star, the stars to be measured are compared indirectly with various well-distributed standard stars whose magnitudes have been determined with all possible care.

The work of the Potsdam astronomers was arranged in four zones extending from the equator to the north pole of the sky. The